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This plant, which is frequently met with upon the continent of the northerly parts of Europe, has been but lately discover'd to grow in England, and that only in one place; *viz.* in a wood not far from Harefield in Middlesex, where it was first discover'd by Mr. Blackstone, an ingenious apothecary in Fleetstreet. This is one of those few plants omitted by the late Mr. Ray in his excellent *Synopsis*, which are found to be natives here; and, from their great scarcity, it is not wonderful, that they were unobserved by that great naturalist.

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LXXI. *An Account of a Machine for killing of Whales, propos'd by John Bond, M D.*

Read April 23, 1752. **B**EFORE I give a particular description of this machine, I humbly beg leave to premise some account of the present method of killing whales, which I have collected from several persons of credit, who have been employ'd at Greenland, that those, who are unacquainted with it, may see, how dangerous and uncertain it is, and how much some improvement is requir'd to render it more successful.

Whales being of the same structure internally with quadrupeds, must come frequently to the surface of the water to breathe; and when they expel the rarefied air from their capacious lungs, thro' a narrow tube, which protrudes above the upper jaw, they occasion a great noise, which the  
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fishers term *the blowing of the whales*. This noise alarms the fishers, who are waiting for that signal ; upon which they furnish a boat with necessary instruments, and row quietly towards the whale. The harpooneer, as they call him, sits rowing in the head of the boat, and observes certain silent signals, which the boat-steerer gives him, to inform him, that he is near enough to strike the whale. Then the harpooner takes the harpoon in both hands, and darts it into the whale ; which, as soon as struck, plunges directly to the bottom, and moves with such prodigious velocity, that the rope, which follows the harpoon, often cuts deep grooves in the boat, and a man stands ready with an ax to cut the rope, if it does not run freely from the coil. The whale being hurt by the harpoon, stays longer than usual under water, till the blood, by the violent motion of the body, is collected about the heart, and consequently obstructed in the head ; the nervous influx is interrupted, the swimming bladder relaxed, and the whale becomes languid, and rises to the top to breathe fresh air, and rests for some time, to recruit its exhausted spirits ; which the fishers observing, row up and dispatch the whale with long lances.

It appears from this account, that the greatest difficulty consists in making the rope fast to the whale, by means of the harpoon ; which is barbed in the common form of a dart, and is generally 20 ounces weight, and about two feet long, with a small stalk of flexible iron, and a socket at the end, about which the rope is spliced with a shaft of wood put into it, so that they cannot throw it any distance with any degree of certainty ; therefore are never sure of  
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darting a whale, till they are within a yard, or directly above her; and there they are so much afraid of being dash'd to pieces, that they often miss good opportunities, tho' they seldom meet with any so tame. They frequently see forty whales within thirty yards of their boats, but cannot strike one, unless it be sleeping, or suckling its young ones. Hence the bad success, and necessity of giving a premium to indemnify the adventurers. Hence we also see, that a machine, which would project a harpoon thirty yards with sufficient force and proper direction, must give a chance for giving thirty whales for one in the common way.

Several machines have been proposed to answer this end, but have all prov'd abortive. The cross-bow was try'd, but was too weak, and subject to break with the frost in those cold climates.

Gunpowder was next applied, I am told with no better success; for, besides the difficulty of applying it to throw those heavy bodies in the form of darts, especially such, as must carry a rope along with them, it frightens all the whales from the place, where it is fired, either by the light, or by the explosion, which it produces; perhaps, both ways; but I imagine, more by the sound than the light; for, in the summer-time, there is in those parts a continual day for several months, so that a flash would not be remarkable. I know it is doubted by the best physiologists, that fishes can hear, or that water, being incompressible, can propagate sonorous undulations below the surface. Notwithstanding the several ingenious experiments, that prove water incompressible, yet there are several facts, that seem to contradict that

that conclusion ; such as the reflexion of hard bodies, which impinge obliquely on the surface of water ; which shews, that water is elastic, and therefore compressible. It will be objected, that the parts of the hard bodies are compressed, not those of the water : but I suspect, if the same means be used to compress a crystal ball, a piece of diamond, or hard steel, we shall have the same reason to conclude them incompressible also ; tho' I am sure, that they will all rebound from water, if they impinge at any angle under fifteen degrees.

I do not doubt the truth of these ingenious experiments, *viz.* that they could no reduce water by any force, which they used, to less bulk ; but we have sufficient reason to doubt, that water is an absolutely hard body. To determine by a fair experiment, if sound could be convey'd under water, I desired an acquaintance to stand on the bank of a river, till I divid'd about three feet under water ; then to pronounce any words he pleased in a pretty strong voice. These words I heard distinctly under water, and repeated them, when I raised my head above the water ; which proves, that sound is convey'd under water, and that fishes may hear, if they have proper organs. In most fishes, which I have examin'd, there are perforations between the eyes and the extremity of the upper jaw, not in the middle, but rather nearer the eyes. Below those holes in the skin, is a pretty large cavity, at the bottom of which is a fleshy substance, which is richly supplied with nerves, by a thick medullary cord, which rises from the anterior lobes of the brain, and passes through the hinder-part of the orbit of the eye, where it divides into several branches,  
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some of which are distributed to the parts about the extremity of the upper jaw, and one large branch is lost in the substance at the bottom of the cavity above describ'd, which I take to be the organ of hearing. This large nerve has been call'd by several authors the olfactory nerve of fishes; but I think it might with more truth and propriety be consider'd as a collection of the nerves, which supply the organs of tasting, smelling, and hearing, confin'd in a sheath, which is a production of the integuments of the brain. From the whole I would conclude, that fishes do hear; and that therefore gunpowder is unfit for projecting harpoons. The machine, which I would recommend for that purpose, is the antient *Balista*, which is accurately describ'd in the thirteenth chapter of Polybius, translated into French by Monf. Folard, who has nicely distinguish'd it from the *Catapulta*, with which most of the antient historians have confounded it, though these machines had distinct officies; for the *Catapulta* threw vast masses of metal and stone in a parabolic curve, and the *Balista* projected darts, some of sixty pounds weight, in a horizontal direction. The projectile power of both these machines depended upon twisted ropes, which mov'd a lever plac'd in their center. In the *Catapulta* this lever mov'd vertically, and threw off globular bodies, as above-mention'd; but in the *Balista* there were two levers, which mov'd horizontally, and acted like a cross-bow. It is needless to enter farther into a description of it, as I have sent an exact model of it to the repository of this Society, to which I refer any gentleman, that has a curiosity to see it.

I was obliged to differ from the antient plan, in adapting it to the harpoon, and have substituted hair-ropes instead of hemp, which the antients used. I have also contrived a new lock, much simpler than any of the cross-bow kind, recommended by Folard. By various experiments I found hairs to be very durable elastic substances, that cannot be sensibly affected by any degree of heat or cold, which the human body can bear. I stretch'd a single hair on a fiddle three inches beyond its natural length; let it stand 24 hours; then relax'd it, and it soon retracted to its former length. A single hair is neither elongated nor contracted by lying in water; but a number of hairs twisted together are shorten'd; which is owing to the attraction of the surfaces, not to the absorption of the supposed internal cavities of the hairs, the existence of which is dubious.

The force of this machine may be increased to any necessary degree, by multiplying the number of springs or ropes, and increasing the length of the lever, which turns the windlace, that draws back the cross cord, or in other words charges it. It has all necessary motions, and is contrived to stand on a pedestal in the head of a boat. It is so simple, that any person may learn how to use it in a short time; and when once it is successfully applied, we shall be no longer obliged to the instruction of the Dutch, who reckon it their interest to obstruct our success in every useful branch of trade.

When the ingenious and benevolent members of this learned Society, have consider'd the importance of this machine, and how far it may promote the public interest, I hope they will recommend the use of it  
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to those, who are concern'd in the whale-fishery; it being foreign to my profession to prosecute the application of it, farther than to give a hint; and also to my inclination, to persecute the government for patents or premiums, according to the modern mercenary custom, leaving such acknowledgments to the public generosity.

I know the application of this machine will be strenuously opposed by the harpooners, because one machine might do more execution than an hundred of them; besides that the ignorant part of mankind has a strong prejudice against all improvements, and a rigid attachment to old methods.

A Dutch captain, who had been many years at Greenland, told me, that, if he had a machine, which would throw a harpoon fifteen yards with sufficient force, he would soon load his ships: but said, that it was impossible to find out such a machine, because his countrymen did not know it.